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How to Teach Calculation Through Realistic Mathematics Education Based on Multisensory

The Theory of Applying Multisensory Methods to Realistic Mathematics Education in Primary Schools

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Abstract

The teacher in teaching the concept of calculation to low-grade primary school students requires specific stimulation. This is because primary school age students are between 6-12 years old who according to Piaget are in a concrete operational phase. The characteristic of this phase is that the child is capable of thinking in order to operationalize logically but concrete objects are still needed. The concept of calculation can be taught through realistic mathematics educati[2] according to the stages, i.e. concrete, representation, and abstract stages. Efforts to optimize realistic mathematics educat[2]n can be done through multisensory methods. Realistic mathematics education based on multisensory is a teaching and learning approach that is able to accommodate students various types of learning to calculate by optimizing various senses that students have, i.e. auditory, visual, kinesthetic, and tactile. The preparation of this paper aims to review the literature in the application of multisensory methods on realistic mathematics education. The scope of this paper is: (1) realistic mathematics education based on multisensory form students about the learning culture of calculating in a diverse and variety; (2) students are able to learn to calculate through the application of realistic mathematics education based on multisensory.

Keywords: *calculation, multisensory, primary school, realistic mathematics education*

Introduction

Knowledge of calculation is the basic ability of mathematics. Knowledge of calculation fosters human thinking skills about the ability to think logically, analytically, systematically, critically, and creatively. Calculating ability in mathematics underlies the development of science and technology in the world, such as the ability to calculate in the fields of algebra, geometry and statistics used in the development of technology and science. Therefore, knowledge of calculation

and mathematics need to be studied as optimally as possible to support technological advances in the future.

Mathematics subjects have been taught since primary school. Even so, there are still many students who claim that learning mathematics is difficult. This is based on the assumption of the general public towards mathematics that mathematics is a difficult and frightening subject. What's more, when mathematics is taught to children who are just learning to calculation and get to know mathematics. This was supported by Fardana & Suprapti's research (Fardana and Tairas, 2012) which showed that 19.5% of primary school students indicated learning difficulties to calculation. Therefore, the teacher in teaching the concept of calculating to low-grade primary school students requires specific stimulation, in order to attract children's interest in calculating and understanding mathematics.

Children of primary school age are between 6-12 years old who according to Piaget are in a concrete operational phase (Wood, Smith, and Grossniklaus, 2001). The characteristic of this phase is that the child is capable of thinking in order to operationalize logically but concrete objects are still needed. The concept of calculation can be taught through realistic mathematics education according to the stages, i.e. concrete, representation, and abstract stages (Kamina, and Iyer, 2009).

Piaget (Ghazi and Ullah, 2015) stated that in teaching the concept of calculation to students in concrete to abstracts stages can be done by enriching students' experiences in representing mathematics. Students' ability to represent mathematics plays a role in increasing calculation competence (Kartini, 2009).

Each student has a different way of constructing mathematical knowledge. Therefore, the teacher needs to try various representations to teach calculation. One effort to optimize the representation stages in realistic mathematics learning can use the multisensory method. Through realistic mathematics education based on multisensory, students are taught knowledge of calculation that can be used to solve various problems in life. This is because the concept of realistic mathematics education based on multisensory is organized based on reality assisted by the use of representations that is able to accommodate student various types of learning to

calculate by optimizing the various senses that students have, i.e. auditory, visual, kinesthetic, and tactile. Realistic mathematics education based on multisensory can also increase learning motivation to calculate because it is contextual in nature, the order of material from easy to more difficult, using media and activating students to do activities (Komalasari and Wihaskoro, 2016; 2017). Thus, through the application of realistic mathematics learning can help teachers in teaching calculation primary school students.

Literature Discussion

The Concept of Learning to Calculate Primary School Students

The purpose of learning mathematics is to develop problem solving, reasoning, communication and connection skills. Even in the 2013 curriculum, the essence of learning mathematics is also no different from the previous curriculum. But in the implementation of mathematics learning in schools, most teachers focus on material components and procedural abilities. As stated by Yurniwati (2015) that the purpose of mathematics learning present time is to achieve the target of graduation. This is evident in the monotonous learning process, one-way communication, more focus on procedural abilities and depending on the textbook.

The learning process results in students only memorizing mathematics and not having an understanding of the correct concept of calculating. This is very unfortunate because reasoning, connection, communication and problem solving are soft skills that help students master other disciplines and help students follow the next level of education. Even needed in the world of work if they mature later.

Based on learning development concept (Thoonen et al, 2010), the teacher's role in teaching calculation in primary school students is to motivate students to find pleasure in learning to calculate. In line with this, there are three stages in learning to calculate:

1. Concrete

   At this stage, students are given understanding and understanding of counting using concrete objects.

2. Representation

   At this stage, the student's thinking process begins to be introduced with a mathematical symbol while being explained through concrete objects.

3. Abstract

   At this stage, students have understood the mathematical abstraction used.

The Concept of Realistic Mathematics Education Based on Multisensory

Improving the quality of mathematics learning needs to be done continuously. The quality of learning includes the learning process, classroom climate, teaching materials, and learning media (Mustika, 2015). Ratih, Sunardi, and Dafik (2013) suggests that students' absorption of material depends on the learning process carried out by students. One of the efforts to improve the quality of learning that can be done is by applying the multisensory model.

The multisensory model is based on the assumption that we move everyday using all the senses. Objects and events can be detected properly, precisely and in accordance with the stimulus, because our brain works by using information derived from (Bhinnety, 2008). According to Feni, Jura, and Paudi (2017) the physical environment and the interaction between students and concrete objects (props) by using a variety of tools that are significant to the quality of learning.

The application of multisensory in learning has the use of teaching aids and the occurrence of discussions between students. One method of learning that has multisensory characteristics is realistic mathematics education. Realistic mathematics education has implementation principles such as contextual, modeling and student contributions. Contextuals become a key form in everyday life that is modeled using teaching aids. In learning using teaching aids, teachers create concept models that can be used with teaching aids, and students can find their own concepts.

Realistic mathematics education based on multisensory is a learning activity that uses the senses in the form of auditory, visual and kinesthetic activities

to obtain knowledge. Auditory, visual and kinesthetic are interconnected with each other to achieve optimal learning and accommodate individuals in learning.

Application of Realistic Mathematics Education Based on Multisensory in Teaching to Calculate Primary School Students

Children who aged primary school are easier to learn to calculate using a concrete model by functioning all senses that are through the process of vision, hearing, movement, and touching. This is reinforced by the opinion (Rose and Nicholl, 2002) which suggests that the more you see, hear, say and do something, the easier it is to learn to calculate.

Realistic mathematics education based on multisensory is based on Freudenthal's view of mathematics as a human activity. From this perspective, students must learn mathematics with mathematical subjects from realistic situations and with their own mathematical activities [Freudenthal, 1991].

Realistic mathematics education based on multisensory involves or activates some sensory in children, i.e. vision (visual), hearing (auditory), movement (kinesthetic), and touching (tactile). The media forms are various card numbers, various color rubber counters, and some media from flannel. This media can be used to introduce the concept of sequence, comparison, pairing, pattern, addition and subtraction by playing with movements such as jumping or clapping (Fitri, Mustaji, and Bachri, 2017).

Activities in realistic mathematics education based on multisensory that vary and involve all sensory children will make it easier for children to understand the material, especially in learning to calculate. These activities are:

1. Visual

   Examples of activities carried out by students are looking at a number card, observing the form of numbers and matching the same number card.

2. Auditory

   Examples of activities carried out by students are listening to the sounds of the number symbols displayed in the learning video media or spoken by the teacher.

3. Kinesthetic

   Examples of activities carried out by students are imitating hand movements in writing number symbols, writing numbers on the table or on the back of friends and continuing with sticking a number card according to the number of objects.

4. Tactile

   Examples of activities carried out by students are using media such as paper or plasticine to feel the shape of numbers that symbolize mathematical abtraction.

There are three basic principles of realistic mathematics education based on multisensory teaching in calculating primary school students, i.e.:

1. Rediscover the calculating process guided throtactiugh progressive mathematization

   The rediscovery process is guided through a realistic problem solving process. Based on this principle, students can build formal mathematical knowledge when students can move from the realistic world to the world of symbols and move in the world of this symbol. Providing appropriate guidance is an important role of the teacher in this process.

2. Didactic phenomenology

   The importance of choosing or designing realistic problems that have the potential to produce formal mathematical knowledge. Therefore, the important role of the teacher is to enrich the student's representation experience.

3. Self-developed model.

   Emphasize the use of the student's own model in solving problems. This is because the teacher is a person who should be able to understand the type of student learning, which must be diversed and varied.

Based on the description above, the primacy of the application of multisensory-based realistic mathematics learning is expected to have an impact,

i.e. (1) the teacher is able to form students about the learning culture of calculating in a diverse and variety; (2) students are able to learn to calculate according to their type and needs in learning.

Conclusion

Based on the discussion, it can be concluded that: (1) realistic mathematics education based on multisensory form students about the learning culture of calculating in a diverse and variety; (2) students are able to learn to calculate through the application of realistic mathematics education based on multisensory.

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